What is Claimed is:

1. A high emission electron emitter, comprising:

an electron injection layer including a front-side surface and a back-side surface;

an active layer of high porosity porous silicon material in contact with the front-side surface;

a contact layer of low porosity porous silicon material in contact with the active layer and including an interface surface; and

an n-type heavily doped region extending inward of the interface surface, the n-type heavily doped region characterized by a low resistivity.

2. The high emission electron emitter as set forth in Claim 1, wherein the electron injection layer comprises an electrically conductive material selected from the group consisting of a **n+** semiconductor, **n+** single crystal silicon, an electrically conductive silicide, an electrically conductive nitride, a metal, and a layer of metal on a glass substrate.

3. The high emission electron emitter as set forth in Claim 2, wherein the **n+** single crystal silicon includes a crystalline orientation selected from the group consisting of a **100** crystalline orientation and a **111** crystalline orientation.

4. The high emission electron emitter as set forth in Claim 2, wherein the electrically conductive silicide is selected from the group consisting of a titanium silicide and a platinum silicide, and the electrically conductive nitride comprises a titanium nitride.

5. The high emission electron emitter as set forth in Claim 1, wherein the back-side surface of the electron injection layer includes an ohmic contact.

6. The high emission electron emitter as set forth in Claim 5, wherein the ohmic contact is made from a material selected from the group consisting of gold, a gold alloy, platinum, a platinum alloy, aluminum, an aluminum alloy, a multilayer of metal, tantalum on top of gold, and chromium on top of gold.

7. The high emission electron emitter as set forth in Claim 1 and further comprising a top electrode in contact with the interface surface.

8. The high emission electron emitter as set forth in Claim 7, wherein the top electrode is made from an electrically conductive material selected from the group consisting of gold, a gold alloy, aluminum, an aluminum alloy, tungsten, a tungsten alloy, platinum, and a platinum alloy.

9. The high emission electron emitter as set forth in Claim 1, wherein the contact layer of low porosity porous silicon material and the active layer of high porosity porous silicon material are a material selected from the group consisting of porous epitaxial silicon, porous polysilicon, porous amorphous silicon, and porous silicon carbide.

10. The high emission electron emitter as set forth in Claim 9, wherein the porous epitaxial silicon is a material selected from the group consisting of **n-** porous epitaxial silicon, **p-** porous epitaxial silicon, and intrinsic porous epitaxial silicon.

11. The high emission electron emitter as set forth in Claim 10, wherein for the **n-** porous epitaxial silicon and the intrinsic porous epitaxial silicon, the n-type heavily doped region of the contact layer includes a dopant material selected from the group consisting of arsenic, phosphorus, and antimony.

12. The high emission electron emitter as set forth in Claim 9, wherein the porous polysilicon is a material selected from the group consisting of **n-** porous polysilicon, **p-** porous polysilicon, and intrinsic porous polysilicon.

13. The high emission electron emitter as set forth in Claim 12, wherein for the **n-** porous polysilicon and the intrinsic porous polysilicon, the n-type heavily doped region of the contact layer includes a dopant material selected from the group consisting of arsenic, phosphorus, and antimony.

14. The high emission electron emitter as set forth in Claim 9, wherein for the porous silicon carbide, the n-type heavily doped region of the contact layer includes a dopant material selected from the group consisting of nitrogen, phosphorus, and vanadium.

15. A method of fabricating a high emission electron emitter that includes an electron injection layer with a layer of silicon material thereon, the layer of silicon material including an active layer of high porosity porous silicon material, a contact layer of low porosity porous silicon material, and an n-type heavily doped region in the contact layer, comprising:

doping an interface surface of the layer of silicon material with a dopant to form the n-type heavily doped region;

anodizing the interface surface in a hydrofluoric acid solution in a preselected optical ambient at a first anodization current density to form the contact layer of low porosity porous silicon material therein;

maintaining the first anodization current density for a first period of time until the contact layer of low porosity porous silicon material has a first thickness;

switching the first anodization current density to a second anodization current density to form the active layer of high porosity porous silicon material; and

maintaining the second anodization current density for a second period of time until the active layer of high porosity porous silicon material has a second thickness.

16. The method as set forth in Claim 15, wherein the doping step is a process selected from the group consisting of an ion implantation, a diffusion, and an insitu deposition.

17. The method as set forth in Claim 16 and further comprising after the doping step:

annealing the layer of silicon material in an inert ambient if the doping process is the ion implantation or the diffusion.

18. The method as set forth in Claim 15, wherein the first anodization current density and the second anodization current density is a selected one of a constant current density and a time varying current density.

19. The method as set forth in Claim 15, wherein the second anodization current density is greater than or equal to the first anodization current density.

20. The method as set forth in Claim 15, wherein the inert ambient is an ambient selected from the group consisting of a vacuum, an inert gas, argon gas, and nitrogen gas.

21. The method as set forth in Claim 15, wherein the first anodization current density is from about 2 mA/cm^2 to about 5 mA/cm^2.

22. The method as set forth in Claim 15, wherein the first thickness is from about 5 nm to about 10 nm.

23. The method as set forth in Claim 15, wherein the second anodization current density is from about 10 mA/cm^2 to about 50 mA/cm^2.

24. The method as set forth in Claim 15, wherein the second period of time is from about 5 seconds to about 2 minutes.

25. The method as set forth in Claim 15, wherein the second thickness is from about 0.5 μm to about 2.0 μm.

26. The method as set forth in Claim 15, wherein the electron injection layer comprises an electrically conductive material selected from the group consisting of a **n+** semiconductor, **n+** single crystal silicon, an electrically conductive silicide, an electrically conductive nitride, a metal, and a layer of metal on a glass substrate.

27. The method as set forth in Claim 26, wherein the **n+** single crystal silicon includes a crystalline orientation selected from the group consisting of a **100** crystalline orientation and a **111** crystalline orientation.

28. The method as set forth in Claim 26, wherein the silicide is selected from the group consisting of a titanium silicide and a platinum silicide, and the electrically conductive nitride comprises a titanium nitride.

29. The method as set forth in Claim 15, wherein the contact layer of low porosity porous silicon material and the active layer of high porosity porous silicon material are a material selected from the group consisting of porous epitaxial silicon, porous polysilicon, porous amorphous silicon, and porous silicon carbide.

30. The method as set forth in Claim 29, wherein the porous epitaxial silicon is a material selected from the group consisting of **n-** porous epitaxial silicon, **p-** porous epitaxial silicon, and intrinsic porous epitaxial silicon.

31. The method as set forth in Claim 30, wherein for the **n-** porous epitaxial silicon and the intrinsic porous epitaxial silicon, the doped region of the contact layer includes a dopant material selected from the group consisting of arsenic, phosphorus, and antimony.

32. The method as set forth in Claim 30, wherein the preselected optical ambient is a dark ambient when the layer of silicon material is **p-** porous epitaxial silicon, and

wherein the preselected optical ambient is an illuminated ambient when the layer of silicon material is **n-** porous epitaxial silicon or intrinsic porous epitaxial silicon.

33. The method as set forth in Claim 32, wherein the first period of time is from about 3 seconds to about 30 seconds.

34. The method as set forth in Claim 29, wherein the porous polysilicon is a material selected from the group consisting of **n-** porous polysilicon, **p-** porous polysilicon, and intrinsic porous polysilicon.

35. The method as set forth in Claim 34, wherein for the **n-** porous polysilicon and the intrinsic porous polysilicon, the doped region of the contact layer includes a dopant material selected from the group consisting of arsenic, phosphorus, and antimony.

36. The method as set forth in Claim 34, wherein the preselected optical ambient is a dark ambient when the layer of silicon material is **p-** porous polysilicon, and

wherein the preselected optical ambient is an illuminated ambient when the layer of silicon material is **n-** porous polysilicon or intrinsic porous polysilicon.

37. The method as set forth in Claim 36, wherein the first period of time is from about 3 seconds to about 30 seconds.

38. The method as set forth in Claim 29, wherein for the porous silicon carbide, the doped region of the contact layer includes a dopant material selected from the group consisting of nitrogen, phosphorus, and vanadium.

39. The method as set forth in Claim 15 and further comprising:

after the second period of time, depositing an electrically conductive material on the interface surface to form a top electrode thereon.